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Environments of War

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Landscape and Fortification of Vienna after the Ottoman Siege of 1529

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This contribution focuses on two issues: first, the land- and waterscape of Vienna in light of modernizations to its fortification; second, the challenges faced in fortifying the city during a period now known as the Little Ice Age. The Ottoman siege of Vienna in 1529 showed that new technology in warfare combined with certain topographic features represented a danger to the town. In reaction to the lasting Ottoman threat, Vienna was fortified with bastions, curtain walls, and a broad moat. The fortifications were surrounded by the glacis, which was cleared of buildings. The emperor's military advisers and Italian fortress architects planned and created an artificial landscape oriented towards military needs. Rivers running through this area, such as the Wienfluss and the Ottakringer Bach, posed strategic problems and had to be dealt with. The Danube floodplain to the northeast of the city was an especially difficult environment to control. Solutions for the waterscape, but also for the hilly terrain in the west had to be found. The city's Danube front was included in the fortifications. This construction took place during a severe phase of the Little Ice Age when heavy rainfall caused frequent inundation and ice jams. High water, unstable sediments, and the erosion of foundations forced planners and builders to find solutions adapted to this special environment. Highlighting these aspects of environment and war in sixteenth-century Vienna is the aim of the paper.

Keywords: Vienna, landscape, waterscape, fortification, bastionary system, early modern period, Ottoman wars, Little Ice Age, climate and history

Introduction

Since the second half of the fifteenth century, the Ottomans had been pushing ever further westward. A decisive victory over the Hungarian King Ludwig II took place at Mohács in 1526. The siege of Vienna in 1529 and the continuing threat from the Ottomans led to a transformation of the immediate surroundings of the city into a fortress and to a rearrangement of the suburbs. The medieval city wall could no longer withstand the new military technology. From 1531 to about 1564, massive fortifications with bastions, connecting ramparts, and a broad moat were built around the inner city (Fig. 1). Large areas of the former suburbs were to be cleared for these buildings, but also for the glacis, the exposed field of fire in front of the moat. In addition, large quantities of building materials and

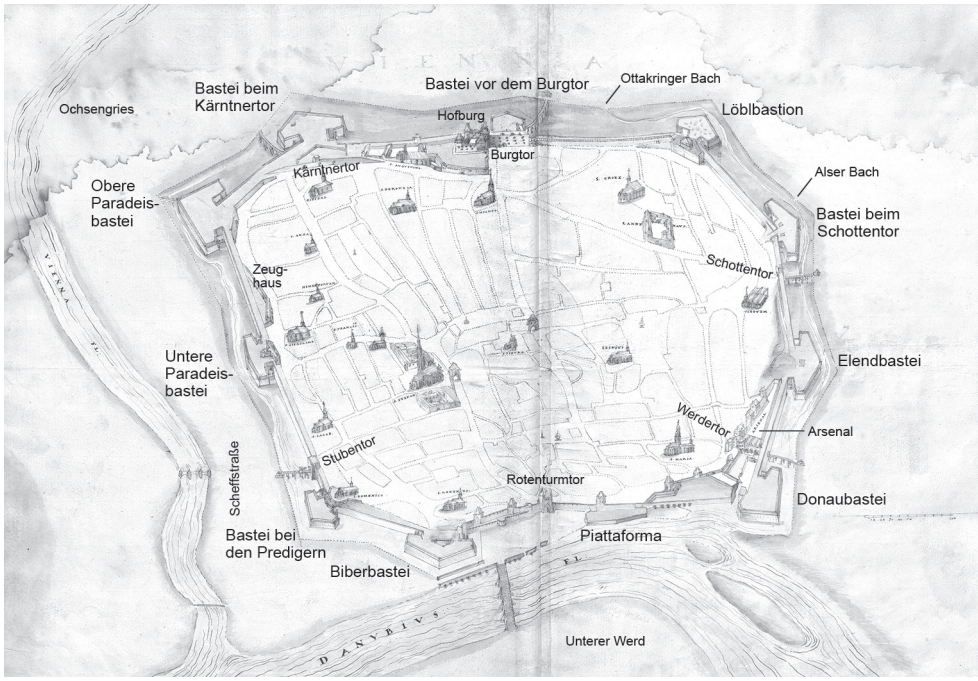

Figure 1. Nicolò Angielini (attributed): The Vienna Fortifications, c. 1570, with the objects mentioned in the text. (Photo by Österreichische Nationalbibliothek Cod. 8609 Han, Nr. 7.)

raw materials had to be procured for the extensive construction project. These included timber, such as wooden piles for the foundations and brushwood for fascines, firewood and clay for the manufacture of bricks, and stone, sand, and lime. Stones came not only from the quarries in the vicinity, but also from the demolished houses and fortifications of the suburbs. Additionally, the earthen material excavated from the moat was used for the ramparts and bastions. All of these measures changed the landscape. They affected not only the immediate physical environment of Vienna, but also had an impact on more distant ecosystems. Another aspect was the awareness of geomorphological difficulties affecting the defense of the city. Thus, the hill in the west of Vienna opposite the *Hofburg* near St. Ulrich was perceived as a problem that demanded a defense solution. A great deal of discussions on defense were devoted to the waterscape of the city. The river bed of the *Wienfluss*/Wien River, flowing close to the city wall, offered protection to attackers and represented a strategic problem, which had to be considered. The Danube, with its barrier function, was the focal point of the defense concept. Tributary rivers flowing into the Danube, such as the *Wienfluss*, the *Ottakringer*, and the *Alser Bach*, which flowed into the moat, and the clay extraction in the western suburbs for brick production, had a landscape-

altering effect. Moreover, the Danube river bank, with its fluctuations in water level and floods, caused difficulties for the construction of the fortress. The climate of the Little Ice Age, a period of cooling in the early modern period, also had an impact. When the fortress construction of the 1550s led to a shortage of resources and provoked enormous costs, testing the budget limit, the solutions and improvements to the fortifications ultimately could not be tackled in the long term, despite numerous proposals and projects.[1]

Topography

When studying fortification activity in the sixteenth century, it should not be forgotten that there is a larger context to the small area being researched. Vienna was founded in a landscape that was and still is—even if it is not visible anymore—shaped by water. It is a town beside a large river: the Danube. Vienna was not located directly on the main stream but on top of an older and higher Pleistocene river terrace. The border between the so-called *Stadtterrasse* and the recent, post-glacial alluvium of the Danube, formed up to 12,000 years ago, coincides with the fortifications of the Roman legionary camp *Vindobona* and approximately with the medieval city walls. The *Ottakringer Bach*, a small stream flowing in from the west, passed the Roman camp directly on its western side. The deep former riverbed is still reflected in today's *Tiefer Graben*. The Danube's main course passed the Roman camp on the northern side. Lying on a terrace above the river, the drop to the Danube was immediate. In the third or fourth century the river eroded the northwestern corner of the camp, which afterwards no longer formed a square. The Danube has played an important role in Vienna's history, as did other water courses forming the Viennese waterscape. The upper reaches of the Danube must be taken into account, as must the centuries preceding the sixteenth century. Though Vienna is situated more than 900 kilometers downstream from the Danube's source, the river still showed a mountainous character with a highly variable flow regime, frequent flooding, and almost annual ice jams.[2]

The local floodplain between the different arms of the Danube consisted of morphologically different dynamic zones, relevant to diverse activities and user groups. On the one hand, there were comparatively stable islands like the

1 For the detailed story of the Viennese fortress in the 16th century, see Opll et al., *Wien als Festungsstadt*.

2 Liepolt, *Limnologie*. For detailed information on river morphology, see Hohensinner et al., "Changes in Water," 147.

central parts of the *Unterer Werd*, an island close to town, and separated from it by the Viennese arm of the Danube, today called the *Donaukanal*. On the other hand, great parts of the river landscape were characterized by large, more or less dynamic islands. The development of the highly sinuous main arm in the sixteenth century had already started by the early to mid-fifteenth century.[3] During the first siege by the Ottoman army in 1529, the evolution of the river bend was already at an advanced stage. First indications of a major rearrangement of the Danube channel network are provided by complaints in the 1550s, but there are also hints from the 1530s (Fig. 2).[4]

This shows that the Danube had already started to shift its course southwards within the gorge known as the *Wiener Pforte*, a short breakthrough section upstream from Vienna and Nußdorf (Fig. 1). From the mid-1560s onward, the main discharge of the river no longer flowed through the bend called the *Taborarm*, but instead found its way through the northern river arms, primarily through the *Wolfarm*.[5]

Apart from the Danube and its major changes of course in the third quarter of the sixteenth century, there are other smaller rivers, streams, and aspects of the terrain which were important for strategic considerations tied to fortification. Vienna is situated at the foothills of the eastern Alps formed by the hills of the Wienerwald. Several streams spring from these foothills to the west of the town and discharge into the Danube in the Vienna area, among them the *Ottakringer Bach* and the *Alser Bach*. Both streams flow to the direct vicinity of the center of town. One river in particular, flowing in from the west, attracted the interest of the fortification planners and engineers: the *Wienfluss*/Wien River. This river passes the town close to the walls on the southeastern side before discharging into the former Viennese branch of the Danube (today *Donaukanal*). Carved into the terrain, its river bed turned out to be a problem for the defense of the city. The same was true for the sloped terrain to the west of the walled town, with the monastery of St. Theobald sitting on top of the highest hill in the direct vicinity. We will return to morphology and strategic considerations later on.

3 WStLA, Hauptarchiv-Urkunden, Nr. 3631.

4 NÖHA W 61/C/87/A (875), fol. 2–59; see also the Hohenauer Steig at the Kahlenberg: NÖHA W 61/C/B7/B (876), fol. 423–604; NÖHA W 61/C/7/A (823), fol.; NÖHA W 61/C/3/A (818), January 22, 1537, fol. 229r.

5 NÖHA W 61/C/7/A (823), fol. 20r/v.; Sonnlechner et al., "Floods," 175–77.

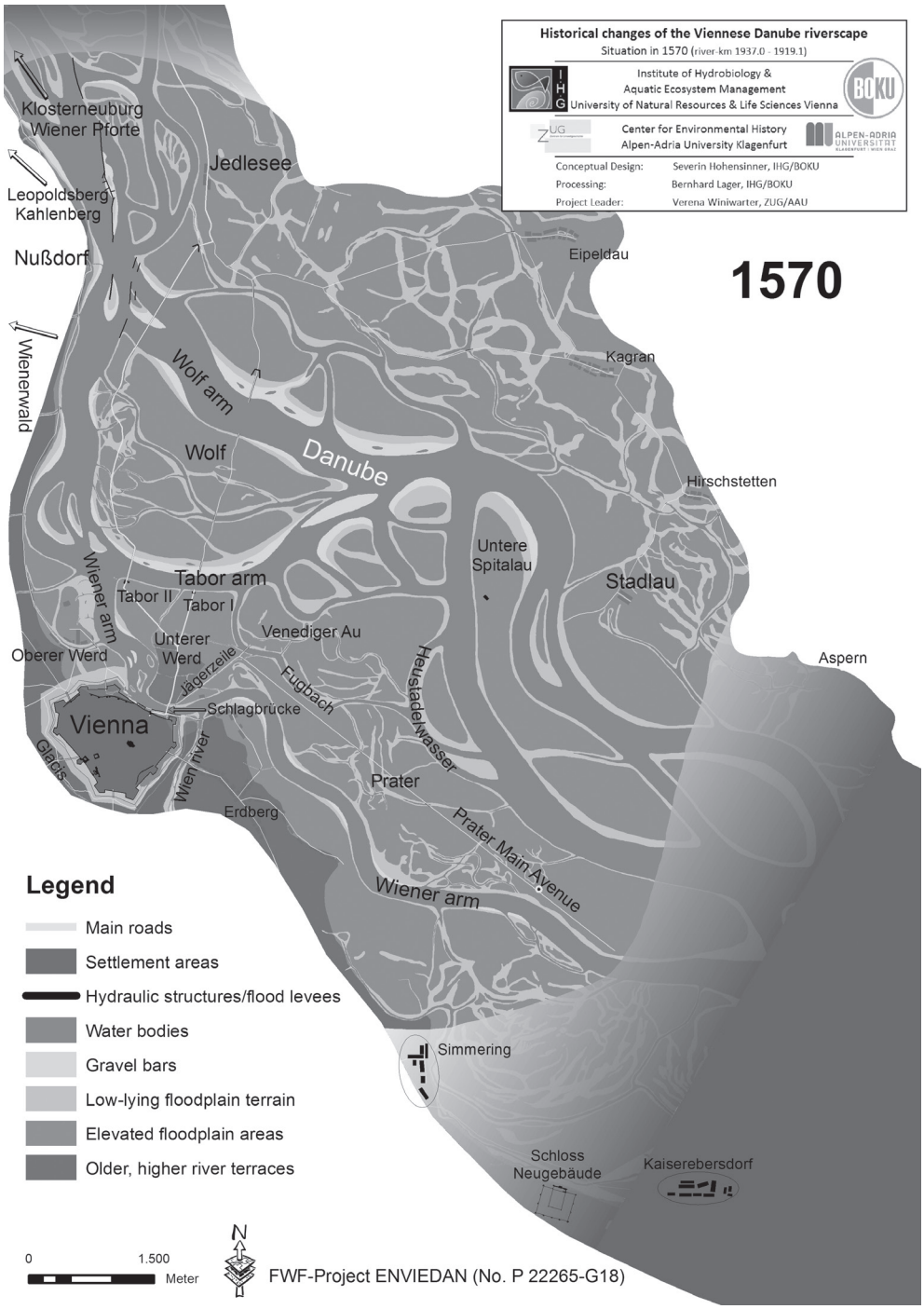

Figure 2. Reconstruction of the Viennese Danube c. 1570
(Reconstruction by Severin Hohensinner and Bernhard Lager)

Building the Fortress

The fifteenth century had brought drastic changes in the field of warfare. Cities were now bombarded by artillery in order to breach the walls. New military techniques required new tactics. The bastionary system developed in reaction to the new weapon, in Italy in particular. However, not only the necessary adjustments to fortress construction, but also the surroundings of the fortifications had to be considered. Open spaces were created, settlements demolished, and the area flattened to deny protection to the enemy. Rivers were diverted, or their barrier function was retained and strengthened.

The Establishment of a Military Landscape Surrounding Vienna—the Construction of the Fortifications[6]

Earliest construction measures (1531–1539)

A transformation in the conduct of war and in military technology took place in the fifteenth and sixteenth centuries. The increasing use of firearms and the development of large caliber artillery and mines, with which walls could be demolished, led to fundamental change in military architecture.[7] Until the Ottoman siege of 1529 the fortifications of Vienna were medieval in character. The city wall had been strengthened against artillery fire by earthen embankments, but with its vertical towers it remained the most important part of the fortifications and the main target of attackers.

In August 1529, immediately before the siege, Ferdinand I of Habsburg, Archduke of Austria and King of Bohemia, Hungary, and Croatia, renewed his call to bring wood for the defense of Vienna as quickly as possible, in order to equip the city with fences, bastions, and bulwarks for cannon.[8] The houses, churches, monasteries/nunneries, and hospitals of the suburbs were only evacuated, set alight or demolished when the Ottoman army was in their immediate vicinity. Wooden roofs in the town were dismantled in order to prevent fires spreading. Such measures were not enough, however. The strength

6 The basis of the following are two publications by the authors: Krause, "Erste Türkenbelagerung von Wien," Krause and Sonnlechner, "Wien wird Festungsstadt."

7 Burger, *Landesfestungen der Hohenzollern*, 14–18; Reichhalter, "Von der Ringmauer zum Festungswall," 149–53.

8 FHKA Gedenkbuch 33, fol. 42v.

of the attackers and their mining tactics meant that the city wall was no longer sufficient for defense. The city survived the attack only because the much more numerous enemy had supply problems and because of the very bad weather that autumn. The Ottoman retreat ruined the suburbs, and there were wide breaches in the city wall beside the *Kärntnertor* (Carinthian Gate), but above all the fear that it might not be possible to withstand a second attack remained. Ferdinand I and his advisors thus sought better defense solutions to combat fears about security. One year after the siege Ferdinand decided to develop the inner city as a fortress, excluding the suburbs, and to strengthen the city wall with *Bollwerke* (bulwarks).[9] According to Ludwig Eberle, nine bulwarks were planned.[10] In the first phase, several structures were to be placed against the outer side of the city wall, while in-between several elevated artillery platforms (cavaliers) would be raised inside the wall and the moat would be defended by flanking positions. The construction of the *Bastei vor dem Burgtor* (Bastion before the Castle Gate), the so-called *Spanier* (Spaniard), began at the beginning of March 1531. The demolition of walls from buildings of the medieval suburb during the excavation of the foundation trench led to higher costs than planned.[11] The erection of the *Bastei beim Schottentor* (Bastion beside the Scottish Gate) followed soon afterwards. The new bastions jutted far out from the medieval city wall and thus extended into the former suburban area. People who lost their houses and ground in the suburbs were resettled. Those whose occupations needed running water were to be settled in the *Scheffstraße* area on the city side of the Wien River between the *Stubentor* (Stuben Gate) and the Danube. Their new houses and workshops were in future to be built not too close to the fortifications and only of wood, so that they could be removed easily in case of siege. An exposed field of fire was to be created in front of the moat (the glacis), so that the area was easily observable and offered no cover to the besieging enemy. The sources show that the ban on erecting buildings within 50 fathoms of the moat was repeatedly violated well into the 1570s.[12] In October 1531, financial difficulties began and activity was on the verge of grinding to halt. The approaching winter cold was a further problem. The Viennese city council also faced high costs, caused by the demolition of (city) towers and the clearance of the moat at that time. It was making slow

9 NÖLA Ständische Akten A VIII 9, September 8, 1530, fol. 10r–11v.

10 Eberle, "Wien als Festung," 220.

11 NÖHA W 61/C/3/A, March 10, 1531, fol. 93r–95v; Camesina, *Urkundliche Beiträge*, no. II, 51 f.

12 Camesina, *Urkundliche Beiträge*, no. V, 55; KA HKR, 1558 February; Expedit 119, fol. 303r; other examples in Eberle, "Wien als Festung," 261 f.

progress in the construction of the *Bastei bei den Predigern* (Preachers' Bastion) because of a shortage of both personnel and money.[13] The appearance and construction details of these bastions remain unknown, with one exception—the *Bastei vor dem Burgtor*. This is thought to be the first angular bastion in the German-speaking area. It survived into the seventeenth century[14] and even after the new castle bastion was built to protect the *Burgtor*. The earliest structures of the new fortifications—called bastions, bulwarks, or "cats" (cavaliers)—appear to have been unstable and to have been rather provisional in nature. The sources imply that the activities were something of a damage limitation exercise and that a comprehensive masterplan, which took into account the strategic situation and included adequate solutions, resource management, and financing, was still absent.

The strengthening of the fortifications on the Wien River side of the city took place between 1536 and 1539.[15] Work is mentioned in the sources at the *Biberbastei*,[16] on an earthwork (*Wasenbastei*) beside *Stubentor*,[17] at the earthwork known as the *Heynersbastei*, and at a further small earthwork that lay between these last two[18] and which appears to have been a predecessor of the later *Untere Paradeisbastei* (Lower Paradise Bastion).[19] The use of the word *Wasen* (= *Rasen* = turf) indicates that the structures largely consisted of earth with a covering of turf. Nevertheless, stone from the abandoned suburban defenses and buildings was also salvaged and reused in the new fortifications.[20] In 1539 a ship—a so-called *Siebnerin*[21]—was bought for the purpose of sinking it in the Danube somewhere between two city towers, the *Salzturm* (Salt Tower) and the *Rotenturm* (Red Tower).[22] It was probably intended to help strengthen the river bank or as the foundation of a built structure. Between 1540 and 1543 there are no sources which tell us about any significant progress in the construction of the

13 NÖHA W 61/C/3/A, October 9, 1531, fol. 90r–91v; Camesina, *Urkundliche Beiträge*, no. VI, 56.

14 Jeitler, "Schriftquellen," 47; Jeitler, "Burgbastei," 176–83.

15 For this phase, see also Eberle, "Wien als Festung," 221.

16 WStLA, OKAR 1536, Ausgaben, fol. 18v, 1537/38, Ausgaben fol. 15r, fol. 17v, 18r/v, fol. 19r.

17 E.g. WStLA, OKAR 1536, Ausgaben fol. 17v–18r.

18 WStLA, OKAR, Ausgaben 1538, fol. 20r und 25v; WStLA, OKAR, Ausgaben 1539, fol. 24v–25v, 29r/v and 31v.

19 Perger, *Straßen*, 27 s. v. Braunbastei. Thus called from 1684 onwards (Camesina, *Urkundliche Beiträge*, no. XXXVI, 91).

20 WStLA, OKAR, Ausgaben 1536–1539, passim; for the medieval suburban defences, see: Opll, *Alte Grenzen*, 43–56.

21 Typical transport ship on the Danube, used for among other things to carry salt.

22 WStLA, OKAR, Ausgaben 1539, fol. 22r.

fortifications. Intensive enlargement work took place later after the appointment of Italian fortification specialists. Bastions were then built which were so strong and large that they remained in use into the nineteenth century.

The construction of five large bastions and the broadening of the moat (1544–1555)

This phase saw the planned extension of the bastion system in the Italian manner and is characterized by a new type of bastion: the bastions are clad in masonry, larger and stronger, and include open flankers (recessed artillery emplacements) for the better protection of the moat area. Between 1544 and 1555 five such bastions were erected, which flanked each other on the landward side of the town. The bastion between the *Burgtor* and the *Schottentor* (later known as the *Löblbastion*) was built between 1544 and 1548. In response to the hill beside St. Ulrich in front of the fortifications, thought to be a potential problem in the case of siege, the bastion was equipped with a particularly high artillery platform (cavalier). A crack in the masonry opened up at an early stage and necessitated repairs.[23] Similar problems developed at the bastion beside the *Schottentor*. The subsoil had not been sufficiently strengthened to support the large, heavy walls. At almost the same time another new bastion was being erected on the other side of the city beside the *Stubentor* in place of the earlier *Bastei bei den Predigern*. It is also referred to as the Town, Burghers', *Hollerstauden*, or Dominican bastion. The Italian fortifications engineer Dominico Illalio (Domenico dell'Allio, born c. 1515, died 1563) designed the bastion in 1544 and marked out its outline on site.[24] A cavalier behind the bastion was begun in 1545, which was raised up with earth from the city moat.[25] The stone bastion with recessed, open flankers, and including the cavalier, which appears to have been finished in 1546,[26] seems to have been something of a prototype for further bastions.

Nevertheless, the system of bastions in the Italian manner remained unfinished and in some places the fortifications would not have been secure if a new siege had taken place.[27] Finances were insufficient, leading to a delay in

23 Jeitler, "Schriftquellen," 51.
24 WStLA, OKAR 1544: Ausgaben, fol. 16r und 18r.
25 WStLA, OKAR 1545: Empfang, fol. 16r und 17r.
26 Camesina, *Urkundliche Beiträge*, no. X 59 f.
27 Eberle, "Wien als Festung," 223.

the completion of the section between *Stubentor* and the *Biberbastei*.[28] The new bastions extended far out into the approaches of the medieval city wall and thus occupied very much space, so much that the surrounding moat had to be broadened with a great deal of effort.[29] The material thus extracted was piled up to create the body of the bastions.

Francesco de Pozo was the responsible master builder for the *Bastei beim Kärntnertor* (Bastion beside the Carinthian Gate), which was erected 1548–1552. The excess earthen material from the foundation trenches was to be brought out of the city to the gardens and cemeteries and spread out there, while buildings on the construction site were to be demolished.[30] Subsidence in the area of the casemates of the bastion led to instability. Again, it would appear that the foundations and/or the subsoil below could not carry the weight demanded.

The so-called *Obere Paradeisbastei* (Upper Paradise Bastion)[31] stood on the other side of the *Kärntnertor* on the Wien River. This was Vienna's largest bastion. It was erected in this phase in place of the earlier *Heynersbastei*. The structure appears to have been built very quickly and to have been finished by 1551.[32] It took its later name *Wasserkunstbastei* (Waterworks Bastion) from a pumping station on top of the bastion that pumped water from the millstream into the city.[33] In this case the new fortifications served the needs not only of defense, but also of supply.

The *Kleine Wasenbastei*, which was built on the Wien River side of the city apparently in the place of the *Untere Paradeisbastei*, and which was also called *Jakoberbastei* (Jacobean Bastion) and later *Braunbastei*, was completed in 1555.[34]

Great numbers of bricks were needed for these projects, necessitating the construction of new brickworks in 1547.[35] Brick production relied on large amounts of firewood, which were to be brought in from the floodplain along

28 Camesina, *Urkundliche Beiträge*, no. XII.

29 FHKA VDA 580, 1545, fol. 258r–272v. For the moat, see also Krause, "Stadtgraben," 36f.

30 NÖHA W 61/3/A, January 13, 1548, [Abschrift], 331r-v; Camesina, Urkundliche Beiträge, no. XIII, 64f.

31 Perger, *Straßen*, 153 s.v. Wasserkunstbastei.

32 Camesina, *Urkundliche Beiträge*, no. XVII, 69 f.

33 Eberle, "Wien als Festung," 234.

34 Eberle, "Wien als Festung," 223 und 233. For these terms, see Perger, *Straßen*, 27, s.v. Braunbastei.

35 FHKA NÖK ER 1547-2, fol. 256v. FHKA NÖK ER 1549-1, fol. 207r: In 1549 the abbot of the Scottish (Benedictine) Abbey complained that the extension of the brickworks had led to the loss of a great deal of land subject to the monastery.

Figure 3. The extraction edge of the *Laimgrube* with the brickworks in the center of the picture. Detail from the Trial of the Assyrian King Sennacherib by Hans Sebald Lautensack, with a view of Vienna in the background, 1558/59 (Photo by © Wien Museum, Inv.-Nr. 31.041.)

the Danube.[36] In 1549 bricks from a total of ten kilns were available for the buildings alongside sufficient lime, sand, and stone.[37]

Most clay was extracted to the west of the city on a hillside called *Laimgrube* (Clay Pit) on the northern side of the Wien River. A view by Hans Sebald Lautensack, dated 1558/59, shows the drying sheds and the cut edge created by clay extraction (Fig. 3). In 1548, further north from the *Laimgrube*, the *Ottakringer Bach*—referred to as "a little stream from St. Ulrich"—flowed to the stone bridge at *Kärntnertor*. Flooding created at that point an undesirable, elevated *Gstätten*, by which is presumably meant a deposit of sediment and other material carried by the stream. In order to prevent the enemy entrenching themselves behind the cover that this deposit provided, it was to be removed and the water diverted into the city moat, as had previously been the case and from which point it could flow into the Danube.[38] These measures led to landscape changes in front of the city. The substantial, protruding fortifications also meant that houses, gardens, and outbuildings in the vicinity, both within and without the city, were adversely affected and sometimes had to be removed.[39]

The plans by Bonifaz Wolmuet and Augustin Hirschvogel, from 1547 and 1549, respectively, reflect developments towards an overall concept for the fortifications (Fig. 4). They show both those bastions that already existed, and

36 FHKA NÖK ER 1548-1, fol. 37r.

37 NÖHA W 61/C/3/A, 1549 June 9, fol. 363v–364r.

38 Camesina, *Urkundliche Beiträge*, no. XIII, 65.

39 Complaints from people affected, claiming compensation, have survived: NÖHA W 61/C/3/B (819), 1550, fol. 367r–389v; April 27, 1551, fol. 428r/v.

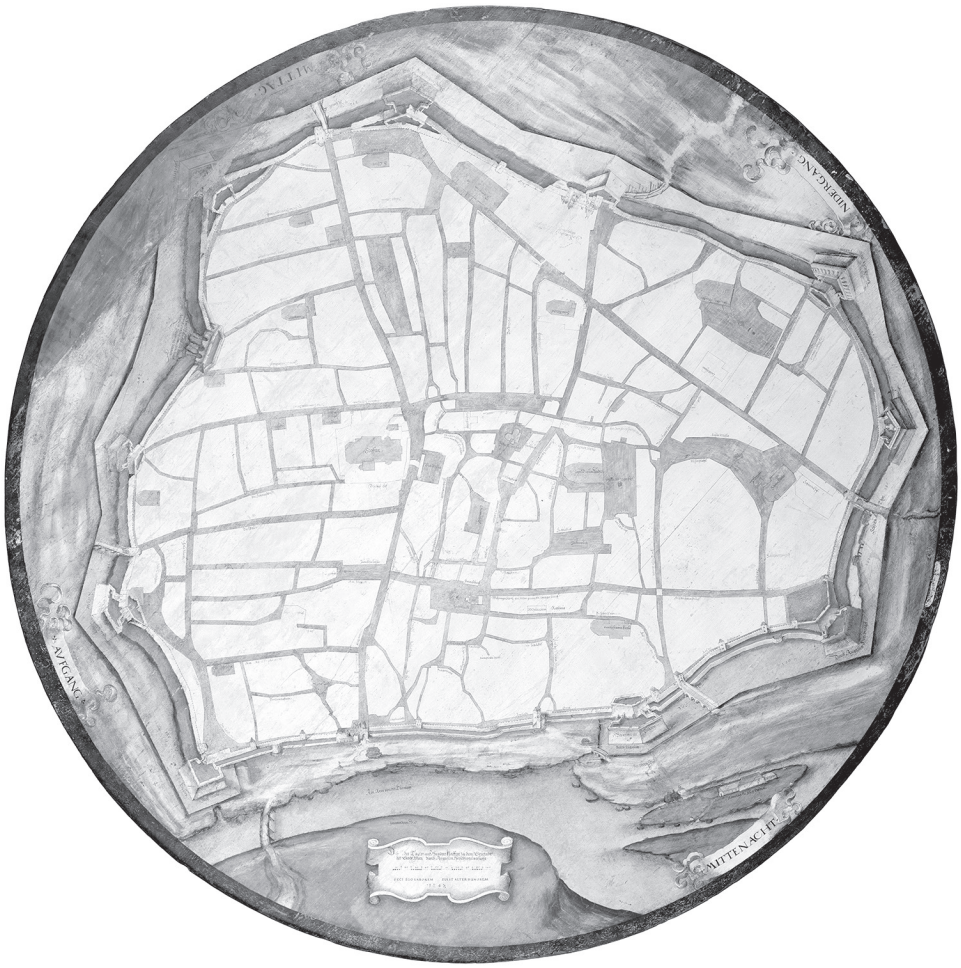

Figure 4. Augustin Hirschvogel: Plan of Vienna, painted on a table top, 1549
(Photo by © Wien Museum, Inv. Nr. 31.022.)

also those which were still in the planning phase. Initially, the course of the medieval city wall was maintained and the bastions were built against the wall. This was still a long way off from an ideal fortification, i.e., a regular, polygonal plan. The terrain, climate problems, the urban landscape, and fear of the likely high costs delayed or prevented the realization of more ambitious plans. The new bastions in this phase served to protect the city gates on the landward side. The integration of the Danube riverbank into the new fortifications and the necessary changes involved were to take place in the coming years.

Fortification of the Danube riverbank and erection of the curtain walls (1557–1563)

The last construction phase under Ferdinand I was marked by acute financial problems, but at the same time by professional planning and attempts to build long-lasting structures appropriate to "modern" military technology. The superintendent of works, Hermes Schallautzer, and following his death in 1561, Thoman Eiseler, as the highest-ranking engineer, were responsible for the construction work between 1557 and 1563. Concepts, estimates, reports, bills, and sketches have survived from this period. The section of the fortifications from *Schottentor* along the Danube to the *Biberbastei* was now to include "modern" bastions and an arsenal. The moat was widened in many places. From 1560 onwards curtain walls were built in front of, sometimes substantially before, the medieval city wall. They were broad ramparts clad in masonry, which connected the bastions. Masonry-clad curtain walls were not erected everywhere, however. Some stretches of the medieval city wall remained intact. New buildings, such as armories, foundries, an arsenal, and a storehouse, were designed directly behind the curtain walls, which served the supply and accommodation needs of the military, but also the storage and repair of military equipment. Work began on the later so-called Lower or Imperial Armory c. 1558.[40] This stood in the area east of the street *Seilerstätte* on the medieval city wall, which at this point followed the undercut former bank of the Wien River, which swung inwards toward the town in a great bow.[41] The new curtain wall between the *Untere* and *Obere Paradeisbastei* was built in a straight line well to the east of the old wall so that the area of the bow was absorbed into the fortifications. The bastion beside the *Schottentor*, which was still not in a satisfactory condition, was to be renewed. Two high cavaliers were being built behind it.[42] Buildings had to be demolished as part of the preparation of the building sites for the *Elendbastei* and the *Donaubastei* (Danube Bastion, also called the *Neutorbastei*) and for the arsenal between them.[43] The arsenal was to be erected outside the medieval city

40 KA HKR Registratur 634, 1558, September, fol. 1r. From c. 1572 onwards the two armouries were referred to as the "Lower" (between the two *Paradeisbasteien*, on the street Seilerstätte) or "Upper" (in the Salzburger Hof complex in the Renngasse) armouries (NÖHA W 61/C/90/B, 1572, fol. 853–857; FHKA Hoffinanzprotokolle E 1576 [W 321/W 322], fol. 157v; KA HKR Protokollbuch 162, 1576, fol. 218r; KA HKR Protokollbuch 158, 1574, fol. 178v); Perger, *Straßen*, 132 s. v. Seilerstätte.

41 Krause, "Stadtgraben," 33 and fig. 2.

42 KA HKR Registratur 634, September 1558, 1r.

43 NÖHA W 61/C/3/B, July 8, 1558, fol. 529r.

wall beneath the escarpment of the Danube,[44] connected by a canal to the river and to house shipyards, workshops, and a small fleet.[45]A new storehouse was to be erected on the site of newly demolished buildings to the south of the arsenal, close to the Salzburger Hof.[46] By 1561 building work on the two bastions and on the arsenal appears to have been largely completed.[47] An undated perspective sketch, which was copied by Albert Camesina in 1879, but is now lost, shows the progress of the building work on the house for the officers and the commander of the arsenal and also on a neighbouring wall, including the former area of those houses which had been demolished to make room for the fortifications.[48] The transformation of the Danube front began towards the end of this phase. A *piattaforma* (platform, Fig. 5) and a new bastion, on the site of the older *Biberbastei*, were to be built, although unstable subsoil, a high water table, and unfavorable weather made the implementation of the projects very difficult. Another negative factor was the precarious financial situation, which deteriorated from

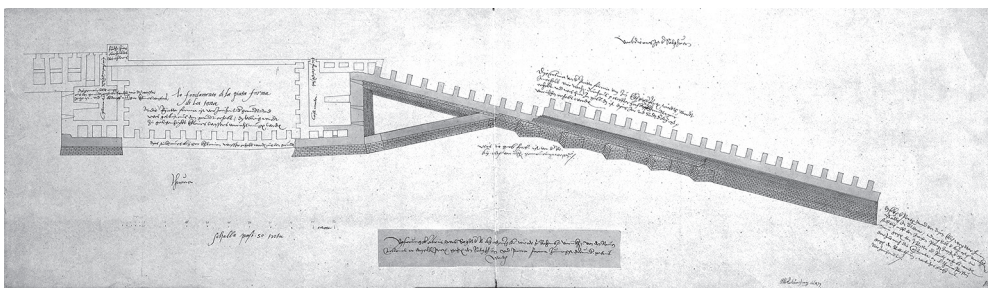

Figure 5. Plan of the building site of the *Piattaforma* (left) and the adjacent curtain wall with cutwaters, copy by Albert Camesina, 1879. (Photo by WStLA, Kartographische Sammlung, Allgemeine Reihe, Pläne und Karten: Sammelbestand, P1.220/4)

44 KA HKR Akten 2, Expedit 109, 1558, August, without folio.

45 Jeitler, "Historische Quellen zur Elendbastion," 216.

46 KA HKR Akten 3, Registratur 634, fol. 1v.; NÖHA W 61/C/90/A fol. 233 (copy of the 19th century) and fol. 396r/v (1547 September 8). See also Veltzé, "Kriegswesen," 208–11. A new Imperial Armoury was built in the Renngasse on the site of the Salzburger Hof 1568/1569: FHKA Hoffinanzprotokolle E 1569 (W 282/W283/W284), fol. 24r und 290v; FHKA Hoffinanzprotokolle E 1568 (W 277/W278/W279), fol. 407r; KA HKR Protokollbuch 150, Registratur, 1569, fol. 147v; NÖHA W 61/C/90/B, 1568 August 11, fol. 825–28.

47 In recent years the Stadtarchäologie Wien has had the opportunity of uncovering and recording the remains of bastions and curtain walls, which were demolished from 1858 onwards, in several places. Excavations at the *Elendbastei* and the *Neutorbastei* led to new results concerning the type of construction and the building materials used, and have been published in two monographs: Sylvia Sakl-Oberthaler et al., *Von der mittelalterlichen Stadtmauer*; Mader, *Die Residenzstadt Wien an der Donau*.

48 WStLA, Kartographische Sammlung, Allgemeine Reihe, Pläne und Karten: Sammelbestand, P1.220/1.

1561 onwards and led to the possibility that work on the fortifications and on other imperial buildings in and around Vienna would not be able to continue at a reasonable pace.[49] The reason for the financial crisis was the enormous costs, which the fortifications against the Ottomans, particularly in Hungary and Croatia involved.[50] In Vienna work came to a temporary halt more or less at the time of the death of Emperor Ferdinand I in 1564. In the following decades we know of suggested improvements by fortifications specialists such as Bartholomeo de Rocchi, Carlo Theti, and Daniel Specklin, but these were not realized.[51] Only in the seventeenth century, in particular under Leopold I (1640–1705), did a further enlargement of the fortifications take place through the addition of ravelins, a covered way, and places-of-arms on the counterscarp. Later still, in the eighteenth century, a system of countermines below the glacis was among the measures taken.[52]

Climate and seasonal construction works

As far as we can tell from the sources and from literature, the timespan between 1547/48 and 1572 in particular brought years of heavy flooding and regular ice jams, both of which caused severe damage. The years from 1565 to 1571 seem to have been the worst in this respect.[53] This period corresponds with the Grindelwald Fluctuation, the first extreme phase of the Little Ice Age lasting from the 1560s to the 1620s.[54]

Assessing the influence of climate change on the changes and dynamics of the Viennese Danube in the sixteenth century is difficult, but embedding the findings into the larger frame of a central European climate history helps interpret the dramatic changes taking place in the riverscape during those

49 KA HKR Protokollbuch 142, 1562, fol. 81v; fol. 82r; 1563 fol. 130v, 135v.

50 Pálffy, "Preis für die Verteidigung," 20–44, esp. 42 f.

51 Opll, Krause and Sonnlechner, *Wien als Festungsstadt*, 489 no. 19, no. 21. Württembergische Landesbibliothek Stuttgart, Handschriften, Cod. math. 4: Daniel Specklin, Codex Mathematicus (ca. 1575); Accessed April 17, 2018. http://www.deutschefotothek.de/gallery/freitext/Codex+mathematicus or http://digital.wlb-stuttgart.de/sammlungen/sammlungsliste/werksansicht/?no_cache=1&tx_dlf[id]=4364&tx_dlf[page]=1

52 Eberle, "Wien als Festung," 223 f; As Terminus ante quem: FHKA Hoffinanz Österreich Fasz. 638; 1702 Juni 1 [Konzept], without folio, with reference to damaged countermines.

53 See foremost NÖHA N 27/B/1-3 (460–62); W 61/C/7/A and B (823, 824); W 61/C/87/A and B (875, 876); also WStLA, Bürgerspital, Spitalmeisterrechnungen, Jg. 1548–1572.

54 Pfister, "Little Ice Age;" Pfister, *Wetternachhersage*; Pfister, "Climatic Extremes;" Glaser, *Klimageschichte;* Hohensinner et al., "Changes in water and land," 148–53.

years. The ice jam flood in 1565 and several severe winter and summer floods in 1566 can be seen as the turning point in the hydromorphological history of the Viennese Danube. At that time, the river definitively relocated its main current to the northern *Wolfarm*. Both sudden erosion processes and gradual channel shifting contributed to the overall instability of the Viennese floodplain and caused numerous disputes concerning land properties and problems with transport routes and infrastructure in the riverscape.

Weather and climate (change) were of great significance for the construction of the fortifications on the Danube front. As early as 1531 the Imperial Military Council emphasized that fortification work would go ahead despite the cold and temperatures below freezing point, thus revealing one of the problems facing the construction work: the rigors of the weather.[55] In 1537 and again in 1546 the mayor and the city council complained to Ferdinand I that the Danube bridges were damaged or had been torn away by the heavy rain and ice flooding.[56] The staff available for repairs was overworked. Apparently the flood had also damaged parts of the fortifications at the *Salztor* (Salt Gate) and *Rotenturmtor* (Red Tower Gate) near the Danube.[57]

The fortification works were obstructed in 1549 by a high water table, which rose steadily in heavy rains. In a desperate step, the builder planked the entire surface of the building and tried to expel all the water. The cost of this measure was considered too high.[58]

A letter dated December 20, 1561 from Thoman Eiseler to the Emperor gives us a glimpse of the seasonality of construction activity, which was only able to progress when the Danube's water level was low, as was normally the case in winter. Eiseler expressed his hope that the water would remain low for two months, which would allow him to complete the work. The Danube and its variability had to be considered in planning and determined the seasonal course of work.[59] It soon became clear that this hope had been in vain. On St. Thomas's Day, December 21, the water began to rise. On January 5, the groundwater level had dropped again, so that Eiseler tried to resume work on the *Piattaforma*. But on the night of the 10th of January and again on almost the entirety of the

55 Camesina, *Urkundliche Beiträge*, 57 no. VII.

56 NÖHA W 61/C/3/A (818), January 22, 1537, fol. 229r.

57 Camesina, *Urkundliche Beiträge*, 63 no. XII: *Item so haben die grossen jetzgewesen güssen die wuern unnd sennkh beim Saltz unnd Rotenthurn seer zerissen, allso das dieselben widerumben aufs paldist, sambt den wuern beim Täber gemacht werden muessen.*

58 Camesina, *Urkundliche Beiträge*, 67 no. XV.

59 Camesina, *Urkundliche Beiträge*, 75 no. XXII.

following day it again rained very heavily. Eiseler knew about the connection between rain in the upper reaches of the Danube and the swelling of the river and feared that it might have rained a lot in the catchment area of the Danube, provoking a renewed expansion of the river. In the spring of 1562 Eiseler urged the emperor to settle the outstanding claims of all contractors so that the workers would be able to take advantage of a potential low water period and proceed with the fortifications.[60] On May 26, he mentions in a letter to Maximilian II three times *klaihn wasser*, i.e., a low water table, as the framework for a reasonable deployment of personnel. A low groundwater level was obviously a prerequisite for good construction progress.[61]

The management of natural dynamics was carried out with appropriate precautionary measures. Construction had to be based on the water and not on the favorable season from the workers' point of view. They had to work in extreme summer heat and in icy winter cold, just as the river allowed.

Strategic challenges to the fortification work caused by topography

Fortifying the city was challenged by environmental prerequisites. As already mentioned, the hilly terrain to the west of the city and also the waterscape caused problems. Clearing the area immediately in front the fortifications from buildings and settlements was one thing. Coping with the terrain was another. The hill close to St. Ulrich in particular, where the monastery of *St. Theobald* was located (today in the 6th district of Vienna), formed a perfect location for the firing of artillery at the town. This can be found in considerations of the authorities.[62] The well-known fortification architect and engineer Carlo Theti (1529–1589) dealt with this subject. He seems to have offered the emperor and his military council a solution to the strategic problem. Two plan sketches by Carlo Theti were recently published.[63] The first includes the design of a citadel in exactly the

60 Camesina, *Urkundliche Beiträge*, 76 f. no. XXIV: May17, 1562. Camesina, *Urkundliche Beiträge*, 78 no. XXV.

61 Camesina, *Urkundliche Beiträge*, 81 no. XXVIII.

62 NÖHA W 61/C/3/A, August 29, 1538, fol. 237r: *So ist die stat an khainem ort dermassen uberhöhet als zu Sannd Tybold, und wo sich in khryegsleuffen der veind daselbst hin mit geschütz legern wurde, nit allain auf denen plätzen, unnd in denen gassen der stat, sonnder auch in der khunigclichen burgkh vor dem geschütz nyemannds sicher sein mugen.*; also NÖLA, Ständische Akten, A VIII, Nr. 9: Oktober 11, 1593, fol. 24r/v: *Zum andern ist aussen auf der Laimgrueben, vor dem purckhthor bey gmainer stat ziegelstadel ain sehr schedliche anhech fast wie ain perg, darauf leicht fünff oder sechs grosse stuckh [geschütz] khennen darauf der feindt gerechtß hinein in die purckh schiessen khönd*t.

63 Mollo, "Carlo Theti," fig. 17–18.

place described, west of the city near *St. Ulrich*, and also an additional fortress wall protecting the Imperial castle. The second reflects the state of the Vienna fortifications. These sketches accompanied Theti's elaborating manuscript from 1576, "Discorsi vari in materia di fortificazione per Vienna, con disegni," which has survived in the Biblioteca Ambrosiana in Milan[64] (Fig. 6). The citadel was never built.

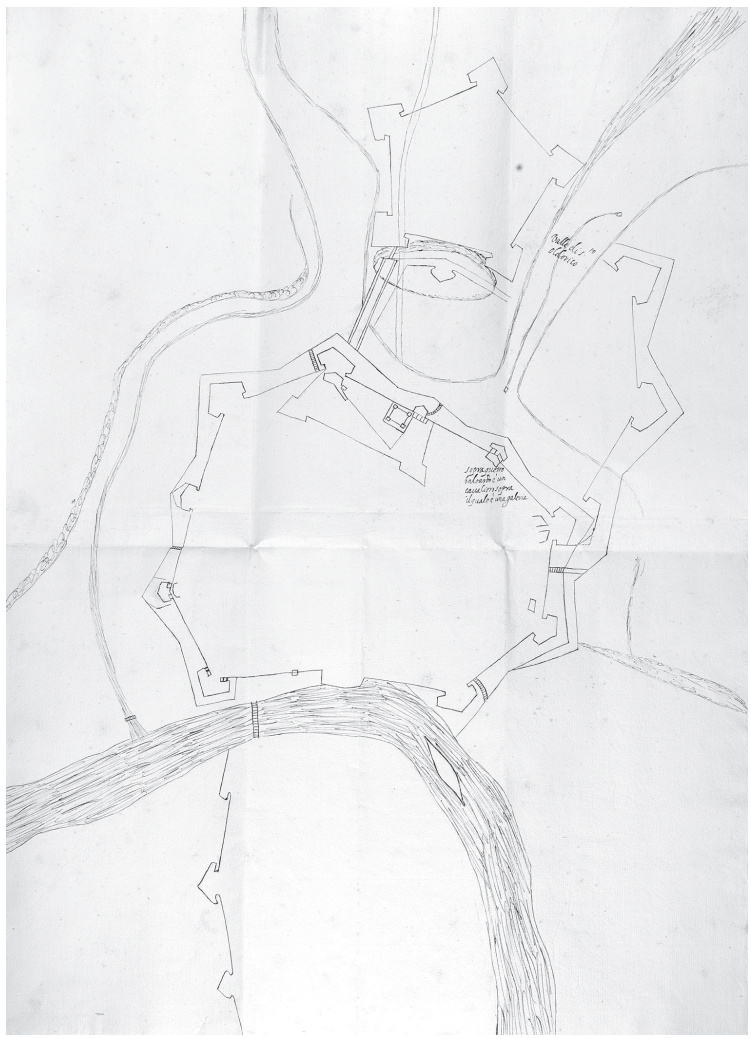

Figure 6. Carlo Theti: Sketch of the Viennese fortress with the project of a citadel on the hill near St. Theobald close to the valley of St. Ulrich (*valle die S.to Olderico*)
(Photo by Biblioteca Ambrosiana di Milano, D 183 inf., f. 9r)

64 Biblioteca Ambrosiana di Milano, D 183 inf., f. 9r.

The second major strategic problem was the Wien River/*Wienfluss*. The river itself flowed in from the west in a wide gravel bed, in some areas with several branches, and passed the walls southwest of the city. It took a winding route, especially with the bend called *Ochsengries*. From 1529 the Wien River was a frequent topic in the discussions of the military about the defense of the city.[65] Particularly noteworthy are the statements of the military councilors during the deliberations on the fortifications along the Hungarian, Italian, and Croatian borders in August and September 1576, which were presented to the emperor and his councilors from October to December 1576.[66] The military discussed the problem of the half-filled urban moat, which was not a proper barrier, and the broad river basin of the Wien River, which offered the enemy an opportunity to find shelter when attacking the town. A look at the two Angielini plans handed down in Karlsruhe and Dresden also shows the quite steep edge of the terrain, in particular from the *Ochsengries* in the south—that section of the *Wienfluss* where its course turns 90 degrees to the north—to the area of the *Stubentor* in the north.[67] A particular problem for the military were the settlements in the area between the *Wienfluss* and the moat and city wall. In particular, the millstream with its mills and stone weirs, which feature prominently in the Karlsruhe and Dresden "Angielini" plans, were to be removed and the technical installations destroyed. The entire area should be levelled as far as possible. Even the deviation of the Wien River into the town for cleaning purposes was considered.[68]

A third major obstacle for the fortification works were the waters of the Danube. As described earlier, the water level varied. The climatic extremes of the Little Ice Age made the work even more complicated. The foundations were the most difficult problem. In 1559 trees in the woods belonging to the Scottish Abbey were to be felled to create construction piles for the foundations of a building planned between the *Biberbastei* and the *Donaubastei*.[69] Whether this is a reference to the preparation of the ground for the construction of a curtain wall and/or for the so-called *Piattaforma* is not clear. A dispute among Imperial engineers about the composition of parts of the *Piattaforma*, which was built directly on the bank of the Vienna arm of the river, shows how systematically

65 Camesina, *Urkundliche Beiträge,* no. V (1531), no. XV (1549), no. XXXVI (1576/77).

66 KA AFA, 1576 13/2 (incorrect 1577 13/2 in the index) fol. 46r–51v; Camesina, *Urkundliche Beiträge*, no. XXXVI, 88–96.

67 Opll, Krause and Sonnlechner, *Wien als Festungsstadt*, 314 f. Tables 2 and 3.

68 Opll, Krause and Sonnlechner, *Wien als Festungsstadt*, 93.

69 Archiv des Schottenstiftes, Chronik des Stiftes Schotten, 2. Abteilung, Bd. 1, (copy), 223.

the appropriate construction methods were discussed. The construction of the masonry part of the *Piattaforma*, which following the opinion of master builder Francesco Theobaldi (died 1569) was to be built without Orillons (ear-shaped plan), was underway in 1561.[70] A drawing copied by Albert Camesina reveals the progress of the construction, including of what the mathematician and cartographer Tilemann Stella (1525–1589) called "corners" on the wall,[71] protruding parts which served as cutwaters (starlings) (Fig. 5). The high water table and problems to do with the foundations meant that water had to be

Figure 7. Wooden pile tipped with iron.
(Photo by © Wien Museum, Birgit und Peter Kainz, Inv. Nr. MV 36.442.)

70 Camesina, *Urkundliche Beiträge*, no. XXII, 75 f.

71 WStLA, Fotosammlung, Fotosammlung allgemein, A 463, without folio.

constantly bailed out and also that wood for ever more and longer wooden piles had to be felled. The piles beneath the curtain walls elsewhere could be driven in much deeper than was possible around the *Rotenturmtor*, where they had to tipped with iron. Wooden piles with iron tips were discovered during the construction of an underground car park at Morzinplatz, the former site of the *Piattaforma*, in 1972 (Fig. 7). The last datable tree ring from such a pile was dated to 1554, proving that the object did indeed originate in the period of construction mentioned in the sources. [72] We do not know when exactly the *Piattaforma* was completed, but by 1563 it was sufficiently finished to begin the construction of the flanking positions.[73] The structure was later replaced by the Great *Gonzagabastei*, completed in 1664.[74] The square platform known as the *Biberbastei*, which was built against the eastern corner of the city wall at the confluence of the Wien River with the Danube, was replaced by a large new structure with casemates and recessed flankers between 1561 and 1563. Work on the foundations ran into difficulties because of the high water levels in the immediate vicinity of the Danube then as well.[75] The site had to be bailed out constantly. The area around the *Biberbastei* was incorporated into the moat, while the river front was not equipped with such a ditch.

Surveying the Waterscape in Order to Resettle the Suburbs

In June 1569 we read of a military project to relocate the suburbs to the *Unterer Werd*. On 4 June of that year, the court military councilor Franz von Poppendorf wrote to tell the emperor that there was a great deal of "disorder" in the suburbs. The suburbs and gardens posed a danger. The inhabitants would have to be removed, but they should be offered replacement land on the island called *Unterer Werd* between *Schlagbruecke* and *Alter Tabor*. Areas had already been marked out. The inhabitants of the suburbs could be relocated within a two-year period.[76]

In December 1577 the emperor commissioned Poppendorf to make a draft plan. Poppendorf inspected the *Tabor* with the fortress architect and engineer

72 Wien Museum Inv.-Nr. MV 36442; dendrochronological sampling by Michael Grabner. It is likely that the outer rings were removed during the manufacture of the piles. Many thanks to Michaela Kronberger, Wien Museum, for this information.

73 Camesina, *Urkundliche Beiträge*, no. XXX, 83.

74 Perger, *Straßen*, 56 s. v. Große Gonzagabastei.

75 Eberle,"Wien als Festung," 230.

76 KA HKR, 1569 Juni Nr. 144 Expedit; 1576/89 Carlo Theti presented his suggestions for fortifying Vienna.

Ottavio Baldigara. Baldigara sketched the situation and surveyed the "island" in the Danube.[77] His conclusion was that part of the island would have to be raised to keep it dry and habitable. Any potential settlers who were concerned about the situation should look to the recently built house of Wolff Fischer as a model for all future houses. Fischer had built up the ground so high that the water was not a danger.

The emperor obviously had doubts about the safety of the new urban settlement between *Schlag-* and *Taborbrücke*. In particular, the emperor asked whether the "new town"[78] would not in fact serve the enemy, and thus be harmful to the city. Poppendorf outlined strategic considerations for the defense of cities and the specific problems of the case of Vienna: the main point of a fortress was that all places around it were cleared and that the enemy was thus deprived of the benefits of settled areas. He can therefore not approach the fortress and is not able to entrench his army or artillery. The enemy must, as far as possible, be stopped outside the city, fought and decimated. Another advantage of stopping him in front of the city was that it would then be possible to observe where he planned to attack the fortification. One must hold off the enemy for as long as possible, so that he would begin to run out of provisions and be forced into a war of attrition. Some drawbacks cannot be averted, he wrote, but the suburbs and gardens, which are detrimental to fortification, should be removed, trenches and cellars filled in, and a flat space established around the city. The suburbs were to be relocated to the island—the *Unterer Werd*.[79] The disadvantages of such a new town would not be comparable to those of the previous condition; there was no advantage for the enemy. Even if the island were not fortified, the enemy would have no advantage over the current situation. If the old city were lost, the new one could decide whether to defend itself or to withdraw the inhabitants across the Danube and destroy the bridges behind it.

The populated and fortified island also had the advantage that the enemy would have to split up his camp, with one part south and one part north of the Danube. He would have to divide his Janissaries—that is, the Ottoman elite troops, of which there were generally about 10,000— because he would be forced to attack two cities at once. He could only build his camp in the floodplains on

77 KA HKR, 1569 Juni Nr. 144 Expedit, Attachment entitled: *Die Insel zwischen Schlag- und altem Täber bruggen, abgewegen durch Otavio Waldegara 17. Decembris anno 1577.*

78 The sources use the term "*newe statt*."

79 KA AFA, 1577 (on the cover of the manuscript: "1576") 13/2; Camesina, *Urkundliche Beiträge*, no. XXXVI, 88–96.

flood-prone terrain, which would be to his disadvantage. In addition, he could not use cavalry in those areas, as they were swampy and crisscrossed by ditches.[80] The planned relocation of the suburban population into a fortified new town would, according to the military council, be the only sensible solution to the problems.[81] Nevertheless, this fortress was not realized in the way the military councilors had proposed.

The waters, especially the Danube as a barrier on the one hand, and the populated and unpopulated Danube floodplains on the other, played a significant role in the deliberations of the military council.

Conclusion

The Ottoman siege of 1529 changed the perception of the town. Its inhabitants had painfully experienced the opportunities inherent in new military technology and control of the Danube. The Viennese were lucky to have beaten back the aggressors. As a consequence a new type of fortification was built: the Italian bastion system. Building materials like wood, clay, or stone were taken from the surroundings of the city leading to further changes in the landscape. The immediate vicinity of the walls was totally cleared of settlement. Planners and engineers presented concepts dealing with fortifying floodplain areas and heights overlooking the city after having studied the strategic risks inherent in the land- and waterscape. The process of building the fortifications, which lasted for the entirety of the sixteenth century and beyond, was impeded by the terrain, especially on the side of the city exposed to the Danube. Structures were eroded and seasonal variation of water levels caused problems. The movement of the Danube away from the town in combination with heavy flooding in the years of the Little Ice Age was clearly observed by the engineers. Several measures were taken to convert the Viennese environment into a military landscape, including the strategic use of natural terrain.

80 Camesina, *Urkundliche Beiträge*, 90.

81 Camesina, *Urkundliche Beiträge*, 90 f.

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